REMARKS

In the Official Action, the Examiner rejected all pending claims 1, 3-17, 19-33, and 35-63. Claims 3, 4, 19, 20, 35, 36, 47, 48, and 54 have been amended by the present Response to set forth the claimed subject matter more clearly. Upon entry of the amendments, claims 1, 3-17, 19-33, and 35-63 will remain pending in the present patent application. Reconsideration of the application as amended is respectfully requested.

Rejections Under 35 U.S.C. § 103

The Examiner rejected claims 1, 13-17, 29-33, 45-47, and 53-54 under 35 U.S.C. § 103(a) as being unpatentable over Schmidt et al. (U.S. Patent No. 5,988,511) in view of Bellaar (U.S. Patent No. 5,861,666). Though the Examiner's rejections are too lengthy to be efficiently reproduced in their entirety, with respect to independent claims 1, 15 and 33, the Examiner stated:

> With respect to claims 1, 13-14 and 31-32, Schmidt et al. discloses a system (see Fig. 4-5) comprising a memory device (comprising elements 3 & 25, Fig. 3) the memory device (3, 25) comprising a plurality of vertically stacked carriers (3, Figs. 3-6), each carrier having a memory chip (25), and wherein the vertically stacked carriers comprise: a plurality of packages (1), each of the plurality of packages (1) comprising a plurality of mateable alignment features (7, Figs. 2 & 4), and wherein each of the plurality of packages (1) is physically coupled to another of the plurality of packages (1); and a plurality of memory chips (25), each of the plurality of memory chips (25) physically coupled to a respective one of the plurality of packages (1).
>
> Schmidt et al. does not teach a system comprising a processor; and a memory device that comprises a plurality of vertically stacked ball grid arrays; each of the plurality of packages comprises vias extending therethrough to connect solder balls of adjacent packages serially. Bellaar teaches a system (Fig. 3) comprising a processor dice (170) and a memory device (comprising elements 134, 137, 180, 122) comprising a plurality of

> vertically stacked ball grid arrays (184) (see Fig. 3, col. 7, lines 55-63); each of the plurality of packages comprises vias (182) extending therethrough to connect solder balls (184) of adjacent packages serially (see col. 7, lines 29-63). Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to modify the system of Schmidt et al. by including a processor and a plurality of vertically stacked ball grid arrays as taught by Bellaar for the purpose of electrical interconnecting each adjacent package.
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> With respect to claim 15, it recites limitation similar to claim 1. Therefore, it is rejected for the same reasons.
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> Claim 33 recites limitations similar to claim 15. Therefore, it is rejected for the same reasons.

Applicants respectfully traverse this rejection. The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (PTO Bd. App. 1979). Obviousness cannot be established by combining or modifying the teachings of the prior art to produce the claimed invention absent some teaching or suggestion support the combination or modification. *See ACS Hospital Systems, Inc. v. Montefiore Hospital*, 732 F.2d 1572, 1577, 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984). Accordingly, to establish a *prima facie* case, the Examiner must not only show that the combination or modification includes all of the claimed elements, but also present a convincing line of reasoning as to why one of ordinary skill in the art would have found the claimed invention to have been obvious in light of the teachings of the references. *See Ex parte Clapp*, 227 U.S.P.Q. 972 (B.P.A.I. 1985). When prior art references require a selected combination or modification to render obvious a subsequent invention, there must be some reason for the combination or modification other than the hindsight gained from the invention itself, i.e., something in the prior art as a whole must suggest the desirability, and

thus the obviousness, of making the combination or modification. *See Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988).

The present application is directed to a system that implements Ball Grid Array (BGA) technology to create a Stacked Ball Grid Array (SBGA). Page 4, lines 14-15. BGA technology offers several advantages over other packaging technologies. *See* page 2, lines 15-20. In the presently described SBGA system, memory chips are mounted to pre-formed packages incorporating BGA technology. Page 4, lines 15-16. The packages include alignment features that are oriented to allow the packages to be stacked. Page 4, lines 16-18. The arrangement of the features allows for alignment and orientation of each package with respect to an adjacent package, while also providing package support during the stacking and reflow process. Page 4, lines 18-21. Advantageously, the alignment features provide maintenance of the stack height and parallelism between packages. Page 4, lines 21-22.

In contrast, and as admitted by the Examiner, the Schmidt reference does not disclose a "memory device comprising a plurality of vertically stacked ball grid arrays," as recited in claim 1. Rather, the Schmidt reference discloses data carriers (1) capable of engaging one another lateral to the longitudinal direction by means of a conventional dovetail guide (7) on one end and by means of an S-shaped contact spring (9) in an opening (8) of the carrier element (3) on the other end. Col. 5, lines 22-27. "The upper part 10 of the contact spring 9 can cooperate with the bottom part 11 of a superposed contact spring 12 of a neighboring data carrier 1 in accordance with the dovetail principle. The elastic cooperation of the contact springs 9, 12 thus assures the frictional, non-positive engagement and a fixed

connection of these ends of the data carrier 1 so that a high contact force there is produced at the same time." Col. 5, lines 27-34.

The Examiner relies on the Bellaar reference to overcome the asserted deficiency of the Schmidt reference, citing Fig. 3 and col. 7, lines 29-63 of the Bellaar reference as providing a memory device comprising a plurality of stacked ball grid arrays (184) and solder balls (184). Applicants respectfully traverse these assertions.

Although the Bellaar reference discloses a stacked chip assembly, it does *not* disclose a ball grid array. Ball grid array packaging technology is well known to those skilled in the art, and those skilled in the art would clearly understand that the stacked chip assembly cited by the Examiner does *not* implement BGA technology. Instead, in one embodiment of the stacked chip assembly , the Bellaar reference discloses "masses of solder 184 are provided on the bottom surface of each lead outer end 147 in alignment with the aperture 182 and with the metal mass 154 of the next lower interposer." Col. 7, lines 40-43. The assembly is bonded together through heat and pressure treatment such that the solder mass 184 is fused with the metal mass 154. Thus, a ball grid array is not used. Accordingly, neither the Schmidt et al. reference, nor the Bellaar reference discloses a ball grid array, much less a stacked ball grid array having the subject matter recited in claim 1.

As discussed above, the cited references fail to disclose all of the elements recited in claim 1. Further, even if the cited combination did disclose all of the elements, the Examiner has failed to meet his burden in establishing a convincing line of reasoning to

support the suggested combination or modification that would be necessary to support a *prima facie* case of obviousness. To the contrary, there is a clear disincentive in combining the cited references in the manner recited by the present claims.

Even if Bellaar disclosed a ball grid array, the Examiner's assertion regarding the motivation to modify Schmidt in view of Bellaar is without merit. The Examiner asserted that the modification of Schmidt would have been obvious "for the purpose of electrically interconnecting each adjacent package." However, as clearly illustrated throughout the Schmidt reference, "the data carriers 1 ... are electrically connected to one another by means of their contact faces 2." Col. 4, lines 49-51. Because Schmidt already discloses electrically interconnected packages, the Examiner's basis for modifying the Schmidt reference is unsupportable.

Still further, the Examiner cited the dovetail guides (7) as correlating with the mateable alignment features recited in the present claims. Even if the dovetail guides (7) could be correlated with the recited alignment features, any suggestion to modify the Schmidt reference in view of Bellaar, would be improper as the suggested modification would clearly render the disclosed device inoperable, as discussed below. A rejection under 35 U.S.C. § 103 based upon a modification of a reference that destroys the intent, purpose or function of the invention disclosed in the reference, is improper and the *prima facie* case of obviousness cannot be properly made. There would be no technological motivation for engaging in the modification or change. To the contrary, there would be a disincentive. *In re Gordon*, 221 U.S.P.Q. 1125 (Fed. Cir. 1984).

As disclosed in the Schmidt reference and noted by the Examiner, the data carriers (1) comprise dovetail guides (7) to assist in stacking the data carriers (1). Col. 5, lines 1-8, 22-28; *see* Figures 2-4. These dovetail guides (7) are used to couple two adjacent data carriers (1). As explicitly disclosed by Schmidt, "[a]s is common with dovetail guides, the individual data carriers are slid into one another. If the dovetail is not deep, a snap-in connection can also be achieved by bending." Col. 5, lines 5-8. As clearly disclosed, the data carriers (1) of the Schmidt reference must be coupled either through sliding or snapping them together. Because of the delicate nature of ball grid arrays, they could not be employed in data carriers comprising the mating features taught by Schmidt. As can be appreciated by those skilled in the art, the frictional force of sliding the data carriers across one another and/or the force of snapping two respective data carriers together would damage the fragile ball grid array. This damage would clearly destroy the intended function of the data carriers and render them unsatisfactory for their intended operation. It is therefore improper to suggest that it would be obvious to one skilled in the art to modify the Schmidt reference by incorporating a ball grid array. Accordingly, for the reasons discussed above, Applicants respectfully request withdrawal of the Examiner's rejection and allowance of claim 1, as well as claims 13 and 14 which are dependent thereon.

Additionally, the Examiner rejected independent claims 15 and 33 under the same reasoning as the rejection of independent claim 1. Claim 15 recites a "memory device comprising a plurality of vertically stacked ball grid arrays." Claim 33 recites "a stacked ball grid array." Because claims 15 and 33 recite subject matter similar to that of claim 1,

independent claims 15 and 33 are also believed to be patentable over the cited art for the reasons discussed above with regard to claim 1. Accordingly, Applicants respectfully request withdrawal of the Examiner's rejections and allowance of claims 15 and 33, as well as claims 16, 17, 29-32, 45 and 46 which are dependent thereon.

With respect to independent claims 47 and 54, the Examiner stated:

> As to claims 47 and 54, Schmidt et al. discloses a device (Figs. 3-5) comprising a chip (25, Fig. 3); and a package (1) operatively coupled to the chip (25), the package (1) comprising: a first side; a second side; a plurality of first mateable alignment features (7, Figs. 2-4) on the first side of the package; and a plurality of second mateable alignment features on the second side of the package (7, Fig. 3).

Independent claims 47 and 54 have been amended to recite a package comprising a die side having a plurality of first non-metal mateable alignment features, and a ball side having a plurality of second non-metal mateable alignment features. The Examiner cited Schmidt as disclosing the alignment features recited in claims 47 and 54. The claims have been amended to specify the location of the recited alignment features. Clearly, the Schmidt reference does not disclose first alignment features on a die side of a package and second alignment features on a ball side of a package as recited in the amended claims. As discussed above with respect to claim 1, the Schmidt reference simply discloses a conventional dovetail guide 7 on one end of a package. As recognized by the Examiner, Bellaar does not disclose any alignment features. Because neither of the cited references, either alone or in combination, discloses every element recited in independent claims 47 and 54, much less provide any suggestion for the modification or combination, the Examiner has failed to meet his burden in establishing a *prima facie* case of obviousness. Accordingly,

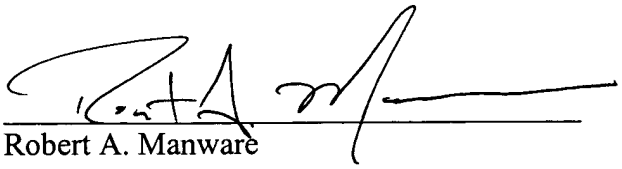
Applicants respectfully request withdrawal of the Examiner's rejection and allowance of claims 47 and 54, as well as claim 53 which is dependent thereon.

The Examiner also rejected claims 3-12, 19-28, 35-44, 48-52, and 55-63 under 35 U.S.C. § 103(a) as being unpatentable over Schmidt et al. (U.S. Patent No. 5,988,511) in view of Mostafazadeh et al. (U.S. Patent No. 5,783,870). However, claims 3-12, 19-28, 35-44, 48-52, and 55-63 are dependent upon independent claims 1, 15, 33, 47, and 54 respectively. The Mostafazadeh et al. reference fails to cure the deficiencies of the Schmidt et al. reference. Accordingly, these dependent claims are also allowable over the references cited by the Examiner for the same reasons provided above with respect to independent claims 1, 15, 33, 47, and 54, as well as for the subject matter recited in each dependent claim. Accordingly, Applicants respectfully request the withdrawal of the rejection and allowance of claims 3-12, 19-28, 35-44, 48-52, and 55-63.

Conclusion

In view of the remarks and amendments set forth above, Applicants respectfully requests allowance of claims 1, 3-17, 19-33, and 35-63. If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,



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